REMARKS

Reconsideration and allowance of the above-identified application are respectfully requested. Claims 1-3, 5-15 and 17-40 remain pending.

Applicant appreciates the Examiner's indication that claims 33-38 include allowable subject matter.

However, claims 1-3, 5-15, 17-24, 28, and 33-40 are now under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,519,705 to Leung. It is assumed that this rejection incorrectly includes claims 33-38 because they are indicated as being allowable and are not discussed in the reasons for rejection. In addition, claims 9, 10, 12, 21, 22, and 24 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the Leung patent in view of U.S. Patent No. 6,597,723 to Zeira et al. These rejections are respectfully traversed.

Specifically, as discussed in more detail below, Applicant respectfully submits that the Leung and Zeira patents relate cellular networks, not to a wireless ad-hoc communication network as recited in the claims. Furthermore, Applicant respectfully submits that among other things, neither patent teaches or suggests *predicting* of path loss of a link *as a function of time* based on information provided to the source node from the destination node pertaining to the characteristics of *at least two messages* that were transmitted by the source node for receipt by the destination node, and then determining a noise factor representing noise at the destination node and calculating the power level and/or data rate at which data is transmitted over the link based on the *predicted* path loss and noise factor as recited in independent claims 1 and 13. Applicant further respectfully

submits that the Leung and Zeira patents fail to tech or suggest that the power level and/or data rate are calculated based on the path loss, noise factor, short term fading experienced by the message *and* sensitivity of a receiver of the destination node as explicitly recited in independent claims 25 and 29, and that the data rate is based on an amount of energy used by a transmitter of the source node to transmit a bit of information of the message as explicitly recited in independent claims 28 and 32.

The details of the rejected claims and the cited references will now be discussed.

As discussed in the Remarks of the previous responses, an embodiment of the present invention provides a technique for determining a power level and/or rate at which data is transmitted over a link between source and destination nodes in a wireless ad-hoc communications network. As described in the specification and as can be appreciated by one skilled in the art, a wireless ad-hoc communications network comprises a plurality of mobile and stationary nodes that can communicate with each other directly or via one or more other nodes that operate as a router or routers for data packets being sent between nodes. In other words, an ad-hoc communications network does not employ base stations as do, for example, cellular telephone networks. As can further be appreciated by one skilled in the art, an ad-hoc communications network is capable of self-healing or, in other words, establishing different paths or links between nodes when an existing path becomes unusable. For instance, if a node in a path becomes inoperative or inaccessible, the other nodes in the path will establish communication with a different node and use that different node to reestablish the path.

Previously amended independent claim 1 defines this embodiment as a method for determining a power level and/or rate at which data is transmitted over a link between source and destination nodes in a wireless ad-hoc communication network. The method comprises the steps of predicting path loss in the link as a function of time based on information provided to the source node from the destination node pertaining to characteristics of at least two messages that were transmitted by the source node for receipt by the destination node, determining a noise factor representative of noise at the destination node, and calculating the power level and/or rate at which the data is transmitted over the link from the source node to the destination node based on the *predicted* path loss and the noise factor. The operations associated with predicting path loss are described, for example, beginning at paragraph 0032. Previously amended independent claim 13 defines the embodiment as a computer readable medium of instructions for performing the operations recited in amended independent claim 1.

In the rejection of claims 1-3 and 13-15 based on the Leung patent, the Examiner contends that Figs. 1-8 of the Leung patent discloses a method for determining the transmit power over a link between a source (105) and destination (130) in a wireless network (10) comprising the operation of predicting path loss in the link as a function of time based on information provided to the source node from the destination node. Evidently, the Examiner interprets the operation of estimating the interference level as corresponding to predicting the path loss in the link. Applicant respectfully disagrees.

Applicant respectfully submits that the Leung system does not predict the variation in time of the path loss. Rather, the Leung system requires monitoring the variation in time of the *interference power*. Interference power is affected by many factors including, but not limited to, the path losses to all nodes causing interference at a destination. These multitudes of path losses are not monitored and are not predicted in the Leung system. Rather, because of the specific field of application of the Leung system, the Leung system does not need to predict the path loss to each individual station. Rather, the Leung technique instead takes into consideration the combined effect of *all* path losses, and the transmit power and mobility of *all* nodes pertaining in all neighboring cells that are causing interference.

For example, column 3 line 62 through column 4 line 6 of the Leung patent describe that "no data contention occurs within the same cell" (column 3, line 65), and that contention can happen from terminals operating in other cells. Therefore, scheduling information cannot be exchanged between base stations which may cause the same time slot to be used simultaneously by terminals operating in different cells or by separate base stations. The fact that more than one mobile or base station can use the same time slot causes interference at the receiving point. Furthermore, the fact that all base stations use TDMA, the interference is systematic (as opposed to random). Therefore, if interference happens during one time slot in one time frame, it will happen during the same time slot in following time frames as well. Since the communication between mobile terminals and base stations is executed on two frequencies channels (uplink and downlink), the terminal affected by interference can request the interfered terminal to change the energy of

communication (increase the power) using the opposite link. Since the interfered device and all interfering sources could be in motion, predicting the level of interference (interference power) is useful for preventing loss of data from one specific terminal.

On the contrary, the embodiments of the present invention as recited in these rejected claims relates to ad-hoc multihopping networks that use one frequency channel for transmitting and for receiving signals. In such an environment, no uplink and downlink frequency channels are available. Also, since it is not a TDMA environment, the interference from other stations is sporadic and has a random character. Therefore, the claimed embodiment does not need to address the prevention or annihilation of interference from other terminals operating in the same frequency channel, and is applicable to one-to-one communication, as opposed to many terminals to one base station that is specific to cellular communications. Thus, monitoring the variation of path loss between terminals is important for maintaining a high level of quality of service.

Again, as mentioned above, the Leung patent relates to environments using base stations and mobile terminals. These systems operate in licensed frequencies, can use very high transmit power and usually have very well exposed antennae. The signal from a base station can be received as far as 20 Km. On the contrary, the claimed embodiments of the present invention relate to ad-hoc multihopping networks that operate in unlicensed frequency bands at very reduced transmit power. The signal from an ad-hoc station propagates in most of the cases not farther than 1 Km, and the "path loss" is a phenomenon caused by environment absorption of radio energy and has a logarithmic variation with the distance. When the mobile is close to the transmitter (less than 1 Km

away, for example), the path loss has a very rapid variation with the distance, and when the mobile is far away from the transmitter antenna, the variation of the path loss is more reduced.

In the Leung system, when the mobile is close to the base station, the signal is also very strong which makes the variation of the path loss to be less important for the quality of communication. However, this is not the case for ad-hoc terminals that operate at very low transmit power. Also, since the ad-hoc terminals operate one in proximity of another, the changes in distance have important effect on path loss. The rapid variation of path loss causes rapid variation of the received signal level which may cause low quality of communication if the effect is not monitored and corrected. This phenomenon does not occur in the Leung system and thus, the Leung system does not need to monitor the variation of the path loss, while an ad-hoc network does.

The Examiner further contends that the technique for computing the noise level described in columns 3-7 of the Leung patent corresponds to the claimed operation for determining a noise factor. Applicant respectfully disagrees. Specifically, Applicant submits that the data used for computing the noise level is different in these two techniques. The Leung technique uses the interference power measured by mobile and transmitted to base station as feedback (see col. 4 lines 29-30 of the Leung patent). On the contrary, the embodiment of the present invention uses the relative frequencies of ACK/NAK received by the transmitter of data messages. Also, columns 3-7 of the Leung patent describe a very accurate analytical method, while the technique according to the

embodiment of the present invention is more of a heuristic nature as can be appreciated from paragraphs [0049] – [0059] of the present application.

Applicant further respectfully submits that the meaning of word "noise" in the context of the Leung patent is different from the term "noise" in the claimed embodiments. Leung considers the "noise" as the fluctuation of the interference power (column 6, line 46), while the embodiments assume the dictionary meaning of the word "noise" as described in paragraph [0050] of the present application as high level electromagnetic energy preventing correct reception of radio signals. In addition, Applicant respectfully notes that the Leung system *computes* the predicted interference level for the next time slot, while the claimed embodiments estimate the level of noise without making any prediction.

In rejecting claims 5-6, 11, 17-18 and 23, the Examiner contends that the Leung patent teaches that "the path loss and noise factor are computed dynamically as conditions of the link change over time and the noise factor increase or decreases an estimated noise factor based on each of message information for a plurality of messages". Applicant respectfully disagrees. Specifically, as discussed above, Applicant respectfully submits that the Leung system does not compute any path loss, but rather, computes and predicts co-channel interference level. On the contrary, the claimed embodiments estimate the noise factor.

In rejecting claims 7-8, 19, 25, 26, 29 and 30, the Examiner contends that column 1, lines 59-66 of the Leung patent teaches the operation of "calculating at least one power level and rate based on predicted path loss, the noise factor, short term fading experienced by the message and

sensitivity of the destination node." However, as discussed in detail above, the Leung system does not compute or predict the path loss. Applicant respectfully submits, therefore, that the Leung system cannot calculate the transmit power and data rate based on path loss predictions. Applicant further respectfully submits that the Leung patent does not disclose any specific method or action for preventing the short time fading (also known as Doppler fading) caused by moving terminals as recited in these claims. Also, the Leung system does not consider "receiver sensitivity" as an issue, because the system does not require such information.

In rejecting claims 39 and 40, the Examiner contends that column 6, lines 9-21 of the Leung patent teach the operation of calculating the transmit power level and data rate to minimize an amount of energy used for transmitting the data over the link. Applicant respectfully submits, however, that this passage of Leung states that the desired result of the relationship in equation (1) set forth in column 6, lines 1-5 is to "choose the minimum power necessary to achieve the target SINR, and therefore minimize any interference with others without degrading the local link quality." (see column 6, lines 10-11). On the contrary, in the claimed embodiments, the minimum transmit energy needed for achieving communication between terminals at a specified success rate is calculated. Based on this minimum energy, the transmit power and the data rate are then computed. Again, the Leung system computes the transmit power for minimizing the interference. If the link quality is low, Leung recommends lowering the data rate, but does not provide any method for computing the data rate.

For all these reasons, Applicant respectfully submits that all claims should be allowable over the Leung patent.

Turning now to the rejection of dependent claims 9, 10, 12, 21, 22 and 24, the Examiner admits that the Leung patent fails to teach or suggest computing receiver sensitivity. However, for this feature, the Examiner relies on the teachings of the Zeira patent. Specifically, the Examiner contends that column 1, lines 55-62 and column 4, lines 27-67 teach the receiver sensitivity computation. Thus, the Examiner contends that one skilled in the art would have found it obvious to employ the techniques taught by the Zeira patent in the Leung system to achieve the claimed embodiments. Applicant respectfully disagrees.

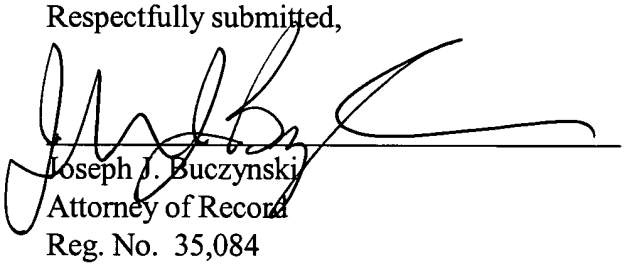
Applicant respectfully submits that the Zeira patent teaches a method for controlling the transmit power in a Time Division Duplex (TDD) communication system, not an ad-hoc communication network. A TDD communication system operates in a similar manner as a telephone TDMA, but requires better quality. Such system used uplink and downlink frequencies and operate at very high transmit power. Column 1, lines 55-62 of the Zeira patent teaches the known concept of a closed loop, and column 4, lines 27-67 teaches an algorithm for "weighted open loop power control". Applicant respectfully submits that neither of these passages relate to computing receiver sensitivity.

Hence, Applicant respectfully submits that one skilled in the art would not have found it obvious or possible to modify the Leung system in accordance with the teachings of the Zeira patent to achieve the claimed embodiments that perform the receiver sensitivity computing

operations recited in dependent claims 9, 10, 12, 21, 22 and 24. Moreover, Applicant submits that the teachings of the Zeira patent fail to make up for the deficiencies in the teachings of the Leung patent with regard to the independent claims as discussed above. Accordingly, all claims should be allowable over the Leung and Zeira patents.

In view of the above, it is believed that the subject application is in condition for allowance, and notice to that effect is respectfully requested. However, should the Examiner have any questions, the Examiner is invited to contact the undersigned at the number indicated below.

Respectfully submitted,



Joseph J. Buczynski
Attorney of Record
Reg. No. 35,084

Gardner Carton & Douglas LLP
1301 K. Street, NW, Suite 900
Washington, DC 20005
Phone: (202) 230-5114
Facsimile: (202) 230-5314

Dated: September 24, 2004

DC01/ 465323.2